

Stereoscopes: Straddling the Line Between Life and Lab

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Stereoscope

A stereoscope is a device used to simulate processes of binocular vision. There are two basic types of stereoscopes: *reflecting stereoscopes*, which use mirrors; and *refracting stereoscopes*, which use prisms or, more commonly, lenses. But regardless of the type of stereoscope, all function to expose two separate images, one to each eye. Although widely known as a popular device for amusement, stereoscopes were a mainstay in early psychology laboratories involved in research on vision.

In 1838, Sir Charles Wheatstone described his design of the first stereoscope he had built as early as 1833. Wheatstone invented a diverse body of devices, such as the English concertina, an early electrical telegraph, and the earliest electromechanical chronoscope. Wheatstone's electromechanical chronoscope was the inspiration for Hipp's famous chronoscope in Germany. He also invented the Playfair cipher, a method of encrypting messages used as late as World War I.

Wheatstone's first stereoscope used mirrors to reflect images from two separate image cards, one into each eye. If one image was of a bird and was reflected to the left eye, and the other image was a bird cage reflected to the right eye, the result was a fusion of the two images resulting in the perception of a single image, a bird in a bird cage. He also designed a refractive stereoscope using prisms rather than mirrors to direct the images to the eyes.

In 1848, David Brewster constructed a refracting stereoscope that he called the *lenticular stereoscope*. He devised it in theory as early as 1843, using semi-double-convex or lenticular lenses rather than mirrors or prisms. The use of lenticular lenses made for a much more compact device as the focal length between the image cards and the eye could be much shorter than with mirrors or prisms. The lenses directed the two images separately to the two eyes. With the invention of a camera that would take photographs with two images, each with the perspective of each eye, the images would be perceived as a single three-dimensional image. The first commercial version of the lenticular stereoscope was produced by Dubosq in Paris in 1850 and was first presented in England at the Great Exposition in London in 1851. The size of the device and the availability of stereoscopic photographs made it practical for recreational as well as scientific uses.

The best-known version of a lenticular lens stereoscope was that devised by Oliver Wendell Holmes in 1862. It is the familiar hand-held stereopticon. It and similar stereoscopes, made by Keystone, Underwood, the American Stereopticon Company and others, were wildly popular well into the 20th century. This device was found in virtually every Victorian parlor and in virtually every psychology demonstration laboratory. Stereoscopes were often the only way Americans could see photographic images until rotograveur photographic printing was invented to print photos in newspapers and magazines. A popular "Mercury" stereoscope made by American Stereopticon Co. from 1904 is housed at the Archives of the History American Psychology (see image above). Two typical binocular fusion cards are shown on the following page.

The Wheatstone, Brewster, and Holmes stereoscopes all played important roles in early psychological laboratories and were also used in classroom demonstrations as well as in student labs. Early psychologists were fascinated with optical illusions and the processes involved in vision. Harvard psychologist Hugo Münsterberg included several stereoscopes in his 1893 listing of equipment in the Harvard psychological laboratory. Stereoscopes were used in research concerning binocular vision. Binocular fusion, the degree to which different images projected on each eye combine to form a composite image, was one area of study. Stereoscopes were also used to measure retinal rivalry, the degree to which one eye dominates over the other in binocular vision. E. B. Titchener taught students in his Cornell laboratory how to draw three dimensional images and understand the principles of the synthetic representation of three-dimensional objects. The Wheatstone stereoscope was altered by Hermann Helmholtz who replaced the cards at the two sides of the device with large mirrors to create the telestereoscope. This allowed the study of the effect of interocular difference on the perception of the third dimension by effectively changing the distance between the eyes up to a meter or more. Other adaptations of the stereoscope, such as the pseudoscope, used mirrors effectively to switch the eyes right to left and left to right to study its effect on perceiving the third dimension.

The stereoscope that became popular as an amusement in the 19th century is still so today. The present-day successor to the Holmes stereopticon is the View-Master, devised by Harold Graves and William Gruber in the 1930s and still familiar today. Though a toy, the View-Master functions similarly to the Holmes stereopticon. It is hand-held but the photographic images are on a circular disk that is rotated by a lever, one pair at a time. There are seven pairs of 16-mm. movie film frames on a disc. Each pair are of a scene photographed by two cameras matching the distance between the eyes. Each photograph is magnified and projected to the appropriate eye, producing a brilliant three dimensional color image. The device was first seen at the 1939 World's Fair in New York and patented in 1940. The View-Master originally was manufactured by Sawyer's in New York City. It is currently made by GAF.

The stereoscope reminds us that the tools of psychological science can find popular appeal. While early psychological laboratories were busy with the scientific investigation of vision, scenes of the Great Chicago Fire on their home stereoscopes enthralled Americans. The stereoscope straddled the line between lab and life and provided an example of the ways in which the nascent science of psychology could serve the public.

For more information see <http://psychclassics.yorku.ca/Munster/Lab/> or <http://cpr.org/Museum/Ephemera/Stereo-Viewers.html>. ?